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STUMBLEUPON

Safer Nanoparticles Spotlight Tumors, Deliver Drugs

February 22, 2009

By Susan Brown

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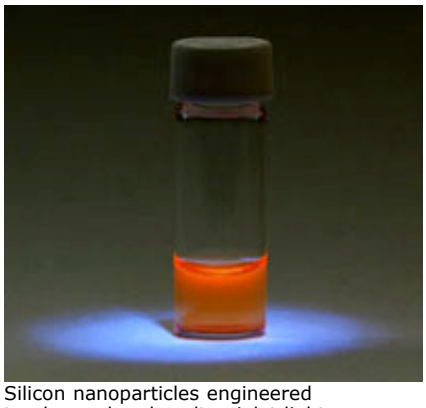
Small is promising when it comes to illuminating tiny tumors or precisely delivering drugs, but many worry about the safety of nano-scale materials. Now a team of scientists has created miniscule flakes of silicon that glow brightly, last long enough to slowly release cancer drugs, then break down into harmless by-products.

"It is the first luminescent nanoparticle that was purposely designed to minimize toxic side effects," said Michael Sailor, a chemistry, biochemistry and bioengineering

professor at the University of California, San Diego who led the study, published in the February 22 online edition of the journal *Nature Materials.*



Silicon nanoparticles engineered to glow red under ultraviolet light. *Photo Credit Luo Gu*

Many nanoparticles tested in research labs are too poisonous for use in humans.

"This new design meets a growing need for non-toxic alternatives that have a chance to make it into the clinic to treat human patients," Sailor said.

The particles inherently glow, a useful property that is most commonly achieved by including toxic organic chemicals or tiny structures called quantum dots, which can leave potentially harmful heavy metals in their wake.

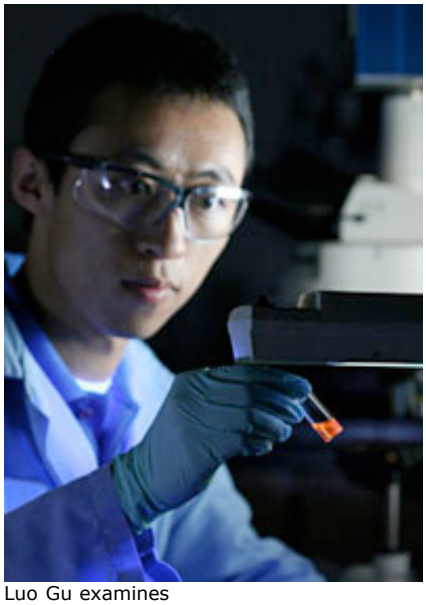
When the researchers tested their safer nanoparticles in mice, they saw tumors glow for several hours, then dim as the particles broke down. Levels dropped noticeably in a week and were undetectable after four weeks, they report.

This is the first sudy to image tumors and organs using biodegradable silicon nanoparticles in live animals, the authors say.

The particles begin as thin wafers made porous with an electrical current then smashed to bits with ultrasound. Additional treatment alters the physical structure of the flakes to make them glow red when illuminated with ultraviolet light.

New nanoparticles illuminate tissues without harm. *Photo Credit Luo Gu*

Luminescent particles can reveal tumors too tiny to detect by other means or allow a surgeon to be sure all of a cancerous growth has been removed.



Luo Gu examines drug-delivering nanoparticles. *Photo Credit Luo Gu*

These nanoparticles could also help deliver drugs safely, the researchers report. The cancer drug doxorubicin will stick to the pores and slowly escape as the silicon dissolves.

"The goal is to use the nanoparticles to chaperone the drug directly to the tumor, to release it into the tumor rather than other parts of the body," Sailor said.

Targeted delivery would allow doctors to use smaller doses of the drug. At doses high enough to be effective, when delivered to the whole body, doxorubicin often has toxic side effects.

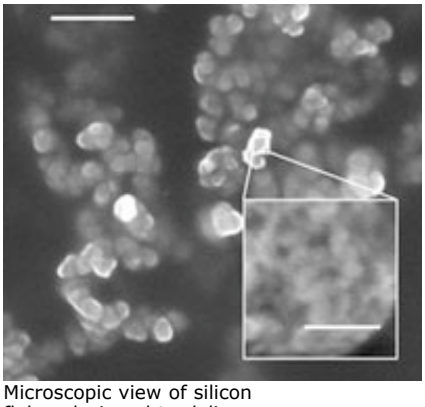
At about 100 nanometers, these particles are bigger than many designed to deliver drugs, which can be just a few nanometers across – a thousand times smaller than the diameter of a human hair.

Their larger size contributes to both their effectiveness and their safety. Large particles can hold more of a drug. Yet they self-destruct, and the remnants can be filtered away by the kidneys.

Close examination of vulnerable organs like liver, spleen and kidney, which help to remove toxins, revealed no lasting changes in mice treated with the new nanoparticles.

Graduate students Ji-Ho Park and Luo Gu in Sailor's lab; Sangeeta Bhatia, bioengineering professor at the Massachusetts Institute of Technology and graduate student Geoffrey von Malzahn in Bhatia's lab; and Erkki Ruoslahti, professor at the University of California, Santa Barbara all contributed to this work.

The National Cancer Institute and the National Science Foundation funded this research.



Microscopic view of silicon flakes designed to delivery drugs, then dissolve away. *Photo Credit Luo Gu*

Media Contact: Susan Brown, 858-246-0161